

**REMARKS**

By the above amendment, Applicant has amended the specification to clarify that the 2 processes shown in the 2 figures are only 2 of the embodiments of the claimed invention. The new statement in the first full paragraph on page 6 clarifies the following statement in the previously amended second full paragraph on page 12: "When the (given or smaller) subset of the input space is a cube, any other tautology checking method in addition to simplification can also be applied after constant substitution."

With this clarification, it is clearer that the claimed invention has novel physical features. In addition, neither the references cited in the rejections nor the prior art provide any suggestion or motivation to combine or modify these references.

**The Claim Rejections Over Okuzawa, Tucker and MPEP 2144.04(VI)(B)**

Claims 1, 4-8, 11-12, and 17 were rejected under 35 U.S.C. 103(a) over Okuzawa in view of Tucker and MPEP 2144.04(VI)(B) legal precedent for duplication.

Applicant requests reconsideration and withdraw of these rejections because of the following reasons (in addition to the dependent claim's dependency to the base claim and any intervening claims):

(1) "**BOOLEAN EXPRESSION**" and "**TRUTH TABLE**" in Okuzawa FIG.1 do not disclose "receiving said Boolean function, said Boolean constant and said given subset of the input space" (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraph 38 of the Final Action). Okuzawa's "**BOOLEAN EXPRESSION**" and "**TRUTH TABLE**" are only used to represent "**UPPER LEVEL LOGIC**" and "**LOWER LEVEL LOGIC**" in FIG. 1, which are the only 2 elements of input data used in the method, as disclosed in FIG. 1 (column 4, lines 33-36). However, the claimed invention uses **3 elements** of input data: a Boolean function, a Boolean constant and a subset of input space, and no 2 of these 3 elements play parallel roles as "**UPPER LEVEL LOGIC**" and "**LOWER LEVEL LOGIC**" do. Okuzawa's 2 elements and the 3 elements in the rejected claims are not equivalent to each other. None of a Boolean function, a Boolean constant and a subset of input space are disclosed in Tucker or MPEP 2144.04(VI)(B), either. Therefore, the rejected claims all have **novel physical features** that are not taught (or suggested) in the combination of the references (see MPEP 2143.03).

(2) Okuzawa's "**COMPARISON**" in FIG. 1 does not disclose any limitation in the rejected claims (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraph 39 of the Final Action). As disclosed at column 4, lines 49-51 and at column 8, lines 37-44, Okuzawa's "**COMPARISON**" in FIG. 1 compares 2 BDDs from the BDD simplification portion. Okuzawa's "**COMPARISON**" does not

work if BDDs are not involved. However, the claimed invention does not involve any BDDs at all. As disclosed in the amended first full paragraph on page 3, it often fails to build BDDs and the claimed invention tries to avoid such disadvantage. This limitation "whereby the conclusion is positive if said Boolean function is equivalent to said Boolean constant within every member of said set of a plurality of smaller subsets of the input space" is not disclosed in Tucker or MPEP 2144.04(VI)(B), either. Therefore, the rejected claims all have **novel physical features** that are not taught (or suggested) in the combination of the references (see MPEP 2143.03).

(3) **Tucker's divide-and-conquer is for a different problem (paragraphs 41, 66 and 101 of the Final Action).** Tucker's divide-and-conquer is about parallel algorithmic techniques and parallel functional programming. It does not disclose anything related to Boolean functions, Boolean constants, subsets of input space, Boolean expressions, logic circuits or truth tables. None of these references suggest any possible combination of methods in solving these different problems (see MPEP 2143.01). Tucker (second paragraph, page 287) discloses that a divide-and-conquer algorithm has to merge "the solution to the subproblems to construct a solution to the original problem". Tucker's 2 solutions of the mergesort example (pages 287-288) and discussion of the first Church-Rosser theorem (page 2034) show the unobviousness of this merge step, and Tucker does not disclose how to do the merge step for any problems

except for mergesort. Actually, it is incorrect to do equivalence comparison by comparing a single logical expression at a time (as suggested in paragraph 42 of the Final Action) due to the difficulty in the merge step, and the claimed invention does not compare a single logical expression at a time. It is also impossible to modify Okuzawa by comparing a single input point or a small region at a time (as suggested in paragraphs 42 and 102 of the Final Action) because Okuzawa does not involve any input point or any region in the comparison step. All these inoperable suggestions (**unsatisfactory for intended purpose unless changing the principle of operation**) prove the unobviousness of combining the references (see MPEP 2143.01). The Office Actions' **failure to suggest any operable combination** of the references (due to the difficult merge step) shows the lack of a **reasonable expectation of success** in any combination of these references (see MPEP 2143.02).

(4) **There is no mere duplication of anything in the claimed invention, Tucker, or Okuzawa as in MPEP 2144.04(VI)(B) (paragraphs 41, 66 and 101 of the Final Action).** The dividing step in claim 1 transforms a hard problem into ones easier to solve because it can have better (new and unexpected) chances to get from step 130 to step 140 in FIG. 1 or from step 230 to step 250 in FIG. 2. The process can end (as the new and unexpected result) without solving any remaining easier problems if it also gets from step 140 to step 190 or from step 250 to step 260. As disclosed in the last paragraph on page 7, it takes only limited rounds of this dividing

step to completely solve the problem so that each step gets closer (newly and unexpectedly) to the end. Among other differences, each of these easier problems after the simplifying step can take less memory than the hard problem so that it has lower probability to run out of memory. Tucker or Okuzawa do not involve mere duplication of anything, either. Therefore, the view of MPEP 2144.04(VI)(B) does not show any obviousness of combining the references without **changing the principle of operation** (see MPEP 2143.01). It is not clear how MPEP 2144.04(VI)(B) is related to Tucker or any limitation of the claimed invention (paragraph 15 of the Final Action) because mere duplication of anything does not help any of them.

**(5) None of the references suggest any combination among Okuzawa and Tucker or MPEP 2144.04(VI)(B), and all 3 references suggest undesirability (experts' skepticism) of such combinations (paragraphs 42 and 102 of the Final Action).** These references are all in different fields, and a person skilled in the art is not supposed to combine references from these fields unless suggested by some of the references. There is **neither suggestion nor motivation** (in the prior art or in the references) to combine references from these fields (see MPEP 2143.01). Okuzawa gives reasons to **avoid some divide-and-conquer methods** at column 1, line 22 through column 2, line 2. Neither Okuzawa nor Tucker suggests dividing the input space into multiple regions and/or smaller regions (as suggested in paragraph 102 of the Final Action). Tucker points

out the possible **disadvantages of divide-and-conquer** in the second last paragraph on page 2034. Tucker recommends **replacing divide-and-conquer with pipelined divide-and-conquer** on page 288, while pipelined divide-and-conquer is not involved in the claimed invention. In the view of MPEP 2144.04(VI)(B), combining these references is **not obvious** because any mere duplication in these methods does not help modifying or combining them. Therefore, a person of ordinary skill in the art would **not have been motivated** (or suggested) to use Tucker and MPEP 2144.4(VI)(B) to modify Okuzawa (see MPEP 2143.01).

(6) Okuzawa's "**SIMPLIFICATION**" and "**COMPARISON**" in FIG. 1 does **not disclose the cube, the simplifying step, the repeating step, or the substituting step in the rejected claims** (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraphs 53, 56, 59 and 77 of the Final Action). As disclosed at column 4, lines 49-51 and FIG. 3 and FIG. 4, Okuzawa's "**SIMPLIFICATION**" in FIG. 1 simplifies BDDs for the BDD comparison part. As disclosed at column 4, lines 49-51 and at column 8, lines 37-44, Okuzawa's "**COMPARISON**" in FIG. 1 compares 2 BDDs from the BDD simplification portion. Okuzawa's "**SIMPLIFICATION**" and "**COMPARISON**" **do not work** if BDDs are not involved. However, the claimed invention does not handle BDDs at all. As disclosed in the amended first full paragraph on page 3, it often fails to build BDDs and the claimed invention tries to avoid such disadvantage. None of the cube, the simplifying step, the repeating step, and the

substituting step in the rejected claims are disclosed in Tucker or MPEP 2144.04(VI)(B), either. Therefore, the rejected claims all have **novel physical features** that are not taught (or suggested) in the combination of references (see MPEP 2143.03). It is not clear how Karnaugh map simplification (paragraph 18 of the Final Action) is related to Okuzawa's simplification or Tucker's divide-and-conquer because Karnaugh map is known in the art only as a manual process but Okuzawa and Tucker are about computer-based processes. The modification should not be **unsatisfactory for intended purpose or changing the principle of operation** (see MPEP 2143.01).

(7) Okuzawa's "**LOGIC CIRCUIT TRUTH TABLE BOOLEAN EXPRESSION**" in FIG. 1 does not disclose a range of binary integers (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraphs 62 and 80 of the Final Action). Sometimes it is impossible to represent certain logic circuit, truth table or Boolean expression as a range of binary integers. Therefore, none of logic circuit, truth table and Boolean expression is equivalent to a range of binary integers though they are related. No range of binary integers is disclosed in Tucker or MPEP 2144.04(VI)(B), either. Therefore, the rejected claims all have this **novel physical feature** that is not taught (or suggested) in the combination of references (see MPEP 2143.03).

Accordingly applicant submits that claims 1, 4-8, 11-12, and 17 are allowable

and solicits reconsideration for rejections (paragraphs 36, 51, 54, 57, 60, 63, 75, 78, and 98 of the Final Action) and allowance.

**The Claim Rejections Over Okuzawa, Tucker, MPEP 2144.04(VI)(B) and Simpson**

Claims 2-3, and 16 were rejected under 35 U.S.C. 103(a) over Okuzawa in view of Tucker and MPEP 2144.04(VI)(B) legal precedent for duplication and Simpson.

Applicant requests reconsideration and withdraw of these rejections because of the following reasons (in addition to the dependent claim's dependency to the base claim and any intervening claims):

(1) Okuzawa's "SIMPLIFICATION" and "COMPARISON" in FIG. 1 does not disclose the simplifying step, the replacing step, or the substituting step in the rejected claims (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraphs 45, 50 and 95 of the Final Action). As disclosed at column 4, lines 49-51 and FIG. 3 and FIG. 4, Okuzawa's "SIMPLIFICATION" in FIG. 1 simplifies BDDs for the BDD comparison part. As disclosed at column 4, lines 49-51 and at column 8, lines 37-44, Okuzawa's "COMPARISON" in FIG. 1 compares 2 BDDs from the BDD simplification portion. Okuzawa's "SIMPLIFICATION" and "COMPARISON" do not work if BDDs are not

involved. However, the claimed invention does not handle BDDs at all. As disclosed in the amended first full paragraph on page 3, it often fails to build BDDs and the claimed invention tries to avoid such disadvantage. None of the simplifying step, the replacing step, and the substituting step in the rejected claims are disclosed in Tucker, MPEP 2144.04(VI)(B) or Simpson, either. Therefore, the rejected claims all have **novel physical features** that are not taught (or suggested) in the combination of references (see MPEP 2143.03).

**(2) Simpson's cube does not disclose the determining step in the rejected claims (As in the first Office Action, the logic of this disclosure's validity is not provided in paragraphs 47 and 97 of the Final Action).** Simpson builds cubes and uses them. Simpson does not determine whether something is a cube or not, and determining is not equivalent to building and/or using. The determining step is not disclosed in Okuzawa, Tucker or MPEP 2144.04(VI)(B), either. Therefore, the rejected claims all have this **novel physical feature** that is not taught (or suggested) in the combination of references (see MPEP 2143.03).

**(3) None of the references suggested any combination among Okuzawa, Tucker, MPEP 2144.04(VI)(B) and Simpson, and all 4 references suggest undesirability (experts' skepticism) of such combinations (paragraph 102 of the Final Action).** Because there are so many different fields, it is not obvious how to combine ideas from these fields unless the combination is suggested. There is **neither suggestion nor**

**motivation** (in the prior art or in the references) to combine references from these fields (see MPEP 2143.01). As clarified in the newly amended first full paragraph on page 6, the basic Boolean cube system does not clearly define the possible input space (as suggested in paragraph 102 of the Final Action) because only the set of relevant variables defines the possible input space. Simpson teaches away from using conventional computer at column 4, lines 48-54 though Simpson uses computer to design the special hardware. Okuzawa gives reasons to **avoid some divide-and-conquer methods** at column 1, line 22 through column 2, line 2. Neither Okuzawa nor Tucker suggests dividing the input space into multiple regions and/or smaller regions (as suggested in paragraph 102 of the Final Action). Tucker points out the possible **disadvantages of divide-and-conquer** in the second last paragraph on page 2034. Tucker recommends **replacing divide-and-conquer** with pipelined divide-and-conquer on page 288, while pipelined divide-and-conquer is not involved in the claimed invention. In the view of MPEP 2144.04(VI)(B), combining these references is **not obvious** because any mere duplication in these methods does not help modifying or combining them. Therefore, a person of ordinary skill in the art would **not have been motivated** to use Tucker, MPEP 2144.4(VI)(B) and Simpson to modify Okuzawa (see MPEP 2143.01). Tucker (second paragraph, page 287) discloses that a divide-and-conquer algorithm has to merge "the solution to the subproblems to construct a solution to the original problem". Tucker's 2 solutions of the

mergesort example (pages 287-288) and discussion of the first Church-Rosser theorem (page 2034) show the unobviousness of this merge step. Actually, **it is impossible to modify Okuzawa by comparing a small region at a time (as suggested in paragraph 102 of the Final Action)** because Okuzawa does not involve any region in the comparison step. This inoperable suggestion (**unsatisfactory for intended purpose unless changing the principle of operation**) proves the unobviousness of combining the references (see MPEP 2143.01). The Office Actions' **failure to suggest any operable combination of the references** (due to the difficult merge step as discussed in Tucker) shows the lack of a **reasonable expectation of success** in any combination of these references (see MPEP 2143.02).

Accordingly applicant submits that claims 2-3, and 16 are allowable and solicits reconsideration for rejections (paragraphs 43, 48, and 93 of the Final Action) and allowance.

**The Claim Rejections Over Okuzawa, Tucker, MPEP 2144.04(VI)(B) and MPEP 2144.04(IV)(A)**

Claims 9-10 and 13-15 were rejected under 35 U.S.C. 103(a) over Okuzawa in view of Tucker and MPEP 2144.04(VI)(B) legal precedent for duplication and further in view of MPEP 2144.04(IV)(A) legal precedent for changing

size/proportion.

Applicant requests reconsideration and withdraw of these rejections because of the following reasons (in addition to the dependent claim's dependency to the base claim and any intervening claims):

**(1) Tucker's divide-and-conquer is for a different problem (paragraphs 70, 74, 84, 88 and 92 of the Final Action).** Tucker's divide-and-conquer is about parallel algorithmic techniques and parallel functional programming. It does not disclose anything related to Boolean functions, Boolean constants, subsets of input space, cubes, or ranges of binary integers. None of Okuzawa, Tucker, MPEP 2144.04(VI)(B) and MPEP 2144.04(IV)(A) suggest any possible combination of methods in solving these different problems (see MPEP 2143.01). Tucker (second paragraph, page 287) discloses that a divide-and-conquer algorithm has to merge "the solution to the subproblems to construct a solution to the original problem". Tucker's 2 solutions of the mergesort example (pages 287-288) and discussion of the first Church-Rosser theorem (page 2034) show the unobviousness of this merge step, and Tucker does not disclose how to do the merge step for any problems except for mergesort. It is impossible to modify Okuzawa by comparing a small region at a time (as suggested in a paragraph 102 of the Final Action) because Okuzawa does not involve any region in the comparison step. This inoperable suggestion (**unsatisfactory for intended purpose unless changing the principle of**

**operation**) proves the unobviousness of combining the references (see MPEP 2143.01). The Office Actions' **failure to suggest any operable combination** of the references (due to the difficult merge step) shows the lack of a **reasonable expectation of success** in any combination of these references (see MPEP 2143.02).

**(2) The claimed invention does not involve mere scaling up of a prior art process capable of being scaled up as in MPEP 2144.04(IV)(A) (paragraphs 70, 74, 84, 88 and 92 of the Final Action).** The dividing, replacing and shifting steps transform a hard problem into ones easier to solve because of the better chances to get from step 130 to step 140 in FIG. 1 or from step 230 to step 250 in FIG. 2. The process can end without solving any remaining easier problems if it gets from step 140 to step 190 or from step 250 to step 260. As disclosed in the last paragraph on page 7, it takes only limited rounds of these steps to completely solve the problem so that each step gets closer to the end. Among other differences, each easier problem can take less memory than the hard problem after the simplifying step. The process to solve the hard problem is not a prior art process because it is not similar to Okuzawa (using BDDs) or Tucker (parallel algorithmic techniques or parallel functional programming) or any other references or any of their possible combinations. Therefore, MPEP 2144.04(IV)(A) or its combination with Tucker does not disclose any limitations in these claims. Because these limitations are not disclosed in other references either, the rejected claims

all have **novel physical features** that are not taught (or suggested) in the combination of references (see MPEP 2143.03). It is not clear how Karnaugh map simplification (paragraph 26 of the Final Action) is related to Tucker's divide-and-conquer because Karnaugh map is known in the art only as a manual process but Tucker is about computer-based processes. The modification should not be **unsatisfactory for intended purpose or changing the principle of operation** (see MPEP 2143.01).

(3) **None of the references suggested any combination among Okuzawa, Tucker, MPEP 2144.04(VI)(B) and MPEP 2144.04(IV)(A), and all 4 references suggest undesirability (experts' skepticism) of such combinations (paragraph 102 of the Final Action).** These references are all in different fields, and a person skilled in the art is not supposed to combine references from these fields unless suggested by some of the references. There is **neither suggestion nor motivation** (in the prior art or in the references) to combine references from these fields (see MPEP 2143.01). Okuzawa gives reasons to **avoid some divide-and-conquer methods** at column 1, line 22 through column 2, line 2. Neither Okuzawa nor Tucker suggests dividing the input space into multiple regions and/or smaller regions (as suggested in paragraph 102 of the Final Action). Tucker points out the possible **disadvantages of divide-and-conquer** in the second last paragraph on page 2034. Tucker recommends **replacing divide-and-conquer with pipelined divide-and-conquer** on page 288, while pipelined divide-and-conquer is not involved in the claimed

invention. In the view of MPEP 2144.04(VI)(B), combining these references is **not obvious** because any mere duplication in these methods does not help modifying or combining them. The view of MPEP 2144.04(IV)(A) **does not show obviousness** of combining these references because merely scaling up does not help modifying or combining them. Dividing the input space into multiple regions and/or smaller regions (as suggested in paragraph 102 of the Final Action) does not involve any mere duplication as in MPEP 2144.04(VI)(B) or merely scaling up as in MPEP 2144.04(IV)(A) because the division has to be exact and a merge step has to be possible. Therefore, a person of ordinary skill in the art would **not have been motivated** (or suggested) to use Tucker, MPEP 2144.4(VI)(B) and MPEP 2144.4(IV)(A) to modify Okuzawa (see MPEP 2143.01).

Accordingly applicant submits that claims 9-10 and 13-15 are allowable and solicits reconsideration for rejections (paragraphs 67, 71, 81, 85, and 89 of the Final Action) and allowance.

### **Conclusion**

For all of the above reasons, applicant submits that the specification and claims are now in proper form, and that the claims all define patentably over the prior art. Therefore he submits that this application is now in condition for allowance, which action he respectfully solicits.

**Conditional Request For Constructive Assistance**

Applicant has amended the specification and claims of this application so that they are proper, definite, and define novel structure which is also unobvious. If, for any reason, this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. § 706.03(d) and § 707.07(j) in order that the undersigned can place this application to allowable condition as soon as possible and without the need for further proceedings.

Very respectfully,



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